Let A O B be the line of abscissæ, and let A O be taken equal to O B, and let each of them be divided into 90 equal parts representing degrees of angle. Let A N be any abscissa representing the angle x, and let the corresponding ordinate N P $= c \sin x$; then the greatest ordinate will be O C $= c$, corresponding to the abscissa A O.

Suppose the curve line A P C B to be divided into 180 parts which correspond to equal divisions on the line of abscissæ A N O B.

Then if E be taken in A O so that E O $= e \times 57{\cdot}296$ divisions, or if A E $= 90 - e \times 57{\cdot}296$ divisions, and if C E be joined and P M be drawn parallel to it through P meeting the line of abscissæ in M, then A M will represent the mean anomaly corresponding to the eccentric anomaly represented by A N.

For, since the triangles P M N, C E O are similar,

$$\frac{\mathrm{MN}}{\mathrm{EO}} = \frac{\mathrm{PN}}{\mathrm{CO}} = \sin x,$$

and therefore M N $=$ E O $\sin x = 57{\cdot}296\ (e \sin x)$.

Hence M N represents the number of degrees in $x - z$, and therefore A M represents the mean anomaly z.

Conversely, if A M represents any given mean anomaly, then if M P be drawn parallel to E C, it will cut the curve in the point P corresponding to the eccentric anomaly.

By the employment of a parallel ruler we may find the eccentric anomaly corresponding to any given mean anomaly, or conversely, without actually drawing a line. For if we lay an edge of the ruler across the points E C and then make a parallel edge to pass through the point M it will cut the curve in the point P required.

Thus we may always find a first approximate value of the eccentric anomaly, without making repeated trials, whether the eccentricity be large or small.

I described this graphical method of solving Kepler's problem at the Birmingham meeting of the British Association in 1849. It is referred to in a paper by Mr. Proctor in vol. xxxiii. of the *Monthly Notices*, p. 390.

The construction is so simple that it has probably been proposed before, though I have nowhere met with it.

Note on Professor Zenger's solution of the same problem given in Number 9 of the last volume of the "Monthly Notices."

The only peculiarity in this solution is in the mode of obtaining the first approximate value employed. The subsequent approximations are carried on by means of the first method given above. Professor Zenger's process may be represented in a slightly different form as follows:—

We have

$$x - z = e \sin x,$$

and therefore

$$\sin (x-z) = \sin (e \sin x) = e \sin x \left\{ 1 - \frac{1}{6} e^2 \sin^2 x + \frac{1}{120} e^4 \sin^4 x - \text{etc.} \right\},$$

or

$$\sin (x-z) = f \sin x ;$$

where

$$f = e \left\{ 1 - \frac{1}{6} e^2 \sin^2 x + \frac{1}{120} e^4 \sin^4 x - \text{etc.} \right\}.$$

Hence

$$\tan (x-z) = \frac{f \sin z}{1 - f \cos z}.$$

Now, an approximate value of f is e, and the error in the determination of $\tan (x-z)$ if we were to put

$$\tan (x-z) = \frac{e \sin z}{1 - e \cos z}$$

would be of the 3rd order in e.

If we determine f so that the error in the determination of x shall vanish when

$$x = \frac{\pi}{2},$$

we shall have

$$f = e \left\{ 1 - \frac{1}{6} e^2 + \frac{1}{120} e^4 - \text{etc.} \right\} = \sin e,$$

and the approximate equation for finding $x-z$ becomes

$$\tan (x-z) = \frac{\sin e \sin z}{1 - \sin e \cos z}.$$

The error still remains in general of the 3rd order in e, but the maximum error will be smaller than when f is taken $= e$.

The value of x given by this equation is readily seen to be equivalent to that given by Professor Zenger's equation,

$$\cot x = \cot z - \frac{e \operatorname{cosec} z}{1 + \frac{1}{6} \sin^2 e + \frac{3}{40} \sin^4 e + \text{etc.}},$$

where we may remark that the quantity

$$\frac{1}{1 + \frac{1}{6} \sin^2 e + \frac{3}{40} \sin^4 e + \text{etc.}}$$

is equivalent to

$$\frac{\sin e}{e}, \text{ or to } \quad 1-\frac{1}{6}e^2+\frac{1}{120}e^4-\text{etc.},$$

a series which converges much more rapidly than the series for its reciprocal, employed by Professor Zenger.

A still more advantageous result may, however, be obtained by determining f so that the error may vanish both when

$$x=\frac{\pi}{3},$$

and when

$$x=\frac{2\pi}{3},$$

that is when

$$\sin x=\frac{\sqrt{3}}{2},$$

so that

$$f=e\left\{1-\frac{1}{8}e^2+\frac{3}{640}e^4-, \text{etc.}\right\}.$$

The order of accuracy of the approximation will not be altered by confining ourselves to the first two terms of this value of f, so that we may take

$$\tan(x-z)=\frac{e\,(1-\frac{1}{8}e^2)\sin z}{1-e\,(1-\frac{1}{8}e^2)\cos z}, \text{ nearly.}$$

The error is still of the 3rd order, but its maximum amount is less than before.

If f be taken

$$=e\left\{1-\frac{1}{6}e^2\sin^2 z\right\},$$

and

$$\tan(x-z)=\frac{f\sin z}{1-f\cos z},$$

the error in the determination of $\tan(x-z)$, and therefore in the determination of x, will be only of the 4th order.

There are several misprints and some errors of calculation in Professor Zenger's paper, on which I need not dwell. *True* anomaly in line 8 of the paper should be *eccentric* anomaly, and the same error occurs on p. 448.

Observations of the Great Comet (b) 1882 *made at the Cambridge Observatory with the Northumberland Equatorial and Square Bar Micrometer.*

(*Communicated by Professor J. C. Adams, M.A., F.R.S.*)

Greenwich Mean Time.	Aberration Time.	Apparent R.A.	Parallax.	Apparent Decl.	Parallax.	Comp. Star.	No. of Comp.
1882.		h m s	s	° ′ ″	″		
Oct. 25·70448	−·00842	10 5 20·019	−0·179	−17 24 19·81	+5·39	*a*	5
		19·724		34·22		*b*	5
·72215	−·00842	10 5 17·982	−0·157	−17 24 45·81	+5·47	*a*	5
		18·029		59·33		*b*	5
		c+1 43·167		*c*+11 37·78		*c*	5
·73970	−·00842	10 5 16·598	−0·132	−17 25 8·30	+5·54	*a*	5
		16·523		20·72		*b*	5
		c+1 41·831		*c*+11 17·89		*c*	5
26·69713	−·00843	10 3 54·135	−0·183	−17 47 3·22	+5·37	*d*	5
·70755	−·00843	10 3 53·366	−0·171	−17 47 15·67	+5·42	*d*	5
		e+1 8·172		*e*+ 3 29·70		*e*	5
·72058	−·00843	10 3 52·289	−0·154	−17 47 29·28	+5·48	*d*	5
		e+1 7·166		*e*+ 3 16·46		*e*	5
		f+0 49·037		*f*+ 8 19·24		*f*	5
29·71667	−·00847	9 59 25·380	−0·144	−18 54 17·89	+5·52	*g*	5
·72439	−·00847	9 59 24·524	−0·133	−18 54 23·54	+5·55	*h*	6
30·71791	−·00848	*i*+2 4·185	−0·137	*i*− 9 49·70	+5·54	*i*	5
·72769	−·00848	*j*+1 12·289	−0·123	*j*− 4 36·50	+5·57	*j*	5
·73965	−·00848	*i*+2 2·318	−0·105	*i*−10 19·85	+5·61	*i*	5
		j+1 11·034		*j* −4 49·15		*j*	5
Nov. 1·71772	−·00850	9 54 42·313	−0·127	−19 59 58·92	+5·57	*k*	7
		42·523		58·65		*l*	7
2·70519	−·00851	9 53 6·800	−0·139	−20 21 22·35	+5·54	*m*	2
·70914	−·00851	9 53 6·420	−0·134	−20 21 27·34	+5·56	*n*	3
·71242	−·00851	9 53 5·772	−0·130	−20 21 32·08	+5·57	*o*	6
5·67997	−·00854	*p*−0 13·977	−0·158	*p*− 7 6·77	+5·48	*p*	5
·70310	−·00854	9 47 59·632	−0·126	−21 25 6·20	+5·59	*q*	5
·70574	−·00854	9 47 58·761	−0·122	−21 25 3·78	+5·60	*r*	3
7·69393	−·00855	9 44 26·324	−0·128	−22 6 32·87	+5·59	*s*	5
·71300	−·00855	9 44 24·540	−0·099	−22 7 3·30	+5·66	*t*	6
		24·366		6 54·47		*s*	6
8·69769	−·00855	9 42 35·101	−0·117	−22 27 11·11	+5·62	*u*	6
		31·674		8·83		*v*	6